Claims

What is claimed is:

1. A resonator probe suitable for use in a magnetic resonance based material detection system, the resonator probe comprising:

a hollow resonator probe body made from an electrically conductive material wherein the probe body has a rectangular volume and at least one resonant frequency;

an inspection volume integrally formed within said hollow resonator probe body, said inspection volume defined by a platform base, an inner top wall, and two inner side walls, said inner side walls connecting the top inner wall and platform base, wherein a sample of material passes through the inspection volume; and

capacitance means electrically connected to said hollow resonator probe body.

2. The resonator probe of claim 1, wherein said resonator probe body is an elongated, square sided toroid.

3. The resonator probe of claim 1, wherein said capacitance means is provided in said resonator probe body.

4. The resonator probe of claim 3, wherein said capacitance means is distributed around a split in the body.

5. The resonator probe of claim 3 wherein said capacitance means runs parallel to a magnetic flux path generated within said resonator probe body.

6. The resonator probe of claim 1, wherein said rectangular volume is an inductive portion of a resonant circuit.

7. The resonator probe of claim 1, wherein the resonant frequency of the resonator probe is determined by an inductance of the resonator probe and a capacitance of the capacitance means.

8. The resonator probe of claim 1, wherein the capacitance means is adjustable.

9. The resonator probe of claim 8, whereby said adjustable capacitance means allows the resonant frequency of the resonator probe to be adjusted.

10. The resonator probe of claim 7, wherein the inductance of the resonator probe is adjustable by providing a means to adjust a cross-sectional area of said resonator probe body.

11. The resonator probe of claim 10, wherein the means to adjust the cross-sectional area of the probe body is comprised of a tuning vane.

12. The resonator probe of claim 1, further comprising an outer electrically conductive electromagnetic shielding layer surrounding the resonator probe body having an opening aligned with said inspection volume.

13. The resonator probe of claim 12 wherein the outer electrically conductive electromagnetic shielding layer comprises thinned areas of conductive material which maintains shielding while permitting X-ray radiation to pass with minimal attenuation.

14. A system for adjusting an inductance of a plurality of resonator probes comprising:

means for binding the motion of a plurality of tuning vanes wherein each tuning vane adjusts a cross-sectional area of a segment of respective resonator probes; and

means to drive said binding means.

15. The system of claim 14, wherein said binding means is a plurality of belts.

16. The system of claim 14, wherein said driving means is a servomotor.

17. The system of claim 14, further comprising control means to control said driving means.

18. A magnetic resonance based material detection and/or analysis system comprising:

a plurality of resonator probe bodies, wherein said plurality of resonator probe bodies comprise a hollow resonator probe body made from an electrically conductive material wherein the probe body has a rectangular volume and at least one resonant frequency, an inspection volume integrally formed within said hollow resonator probe body, said inspection volume defined by a platform base, an inner top wall, and two inner side walls, said inner side walls connecting the top inner wall and platform base, wherein a sample of material passes through the inspection volume, and capacitance means electrically connected to said hollow resonator probe body.

radio frequency pulse generator connected to said probe for producing an applied magnetic field within at least one probe body;

sensor for detecting a magnetic field produced by a sample after being exposed to said applied magnetic field; and

a controller to selectively energize the radio frequency pulse generator and/or sensor.

19. The system of claim 18, further comprising: an inductance adjuster capable of varying the inductance of at least one resonator probe and a controller to control said inductance adjuster.

20. The system of claim 18 further comprising a conveyor for carrying objects through the inspection volume and a controller to control the conveyor.

21. The system of claim 18 further comprising at least one other detection and/or analysis system.

22. The system of claim 21 wherein said other detection and/or analysis system is one of the following: a CT scan system or a X-ray scan system.

23. A method for adjusting an inductance of a plurality of resonator probes comprising:

binding the motion of a plurality of tuning vanes using a plurality of connectors wherein each tuning vane adjusts a cross-sectional area of a segment of respective resonator probes; and

driving said connectors to concurrently move a plurality of tuning vanes.

24. The method of claim 23, wherein said connectors are a plurality of belts.

25. The method of claim 23, wherein said driving is achieved using a servomotor.

26. A method of performing magnetic resonance based material detection and/or analysis comprising the steps of:

activating a radio frequency pulse generator to produce an applied magnetic field within at least one probe body; and

sensing a magnetic field produced by a sample after being exposed to said applied magnetic field; wherein the at least one probe body is hollow and made from an electrically conductive material; wherein the probe body has a rectangular volume; wherein an inspection volume is integrally formed within said hollow resonator probe body; and wherein a capacitance means is electrically connected to said hollow resonator probe body.